

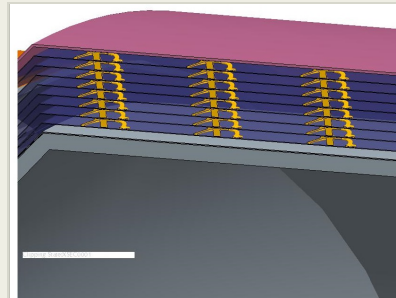
Multi-Environment MLI: Novel Multi-Functional Insulation for Mars Missions, Phase I

Completed Technology Project (2017 - 2017)



Project Introduction

Human exploration requires advances in cryogenic propellants for missions to Earth orbit, cis-lunar, Mars and beyond. NASA is interested in improving thermal insulation for future Mars missions, including Evolvable Mars Campaign, Mars Landers and Mars ISRU cryogenic fuel storage on Mars surface. Cryogenic propellants have the highest energy density of any chemical rocket fuel, propel most NASA and commercial launch vehicles, and would be used for Mars Lander EDL/ascent. Cryogenic propellants require good thermal insulation. Improvements in propellant storage and transfer are a critical need for future NASA missions, with zero boil off of cryogenic propellant an important goal. High performance insulation is needed for future Mars missions to store liquid methane obtained from the Mars regolith and stored on Mars surface. Quest Thermal Group proposes to design and develop an innovative, lightweight thermal insulation system, designed to perform and insulate cryogenic propellants in multiple environments, such as in-air on Earth prelaunch and launch ascent, in-space cruise phase, on-Mars surface and during Mars Lander ascent. Multi-Environment MLI (MEMLI) is a novel multi-functional thermal insulation system that uses a ventable/sealable, lightweight supported vacuum shell, integrated and supported by Load Bearing MLI layers specifically tuned for Mars atmosphere. MEMLI will be engineered to provide high performance in-air, in-space and on-Mars, could provide <130 W/m² in-air, <0.25 W/m² in-space, <0.75 W/m² on Mars surface with a robust, lightweight system with a mass about 1 kg/m². Phase I goals are to develop a new high performing insulation structure capable of supporting Mars missions and prove feasibility of the MEMLI concept for future NASA programs. A MEMLI prototype will be modeled, designed, built and tested for thermal performance in multiple environments.



Multi-Environment MLI: Novel Multi-functional Insulation for Mars Missions, Phase I Briefing Chart Image

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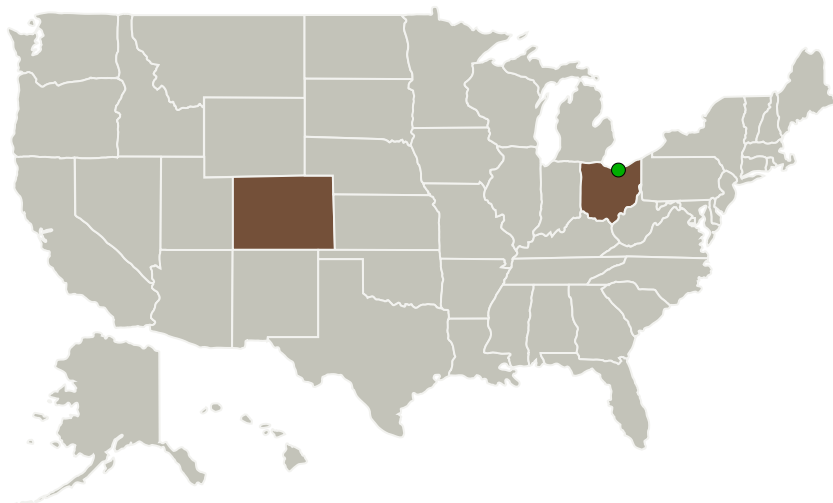
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Quest Thermal Group	Lead Organization	Industry	Arvada, Colorado
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Colorado	Ohio
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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Quest Thermal Group

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

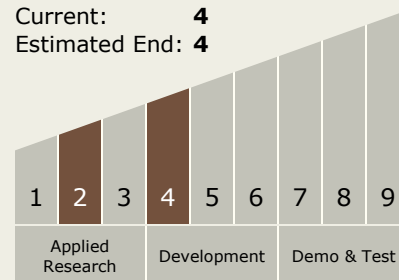
Carlos Torrez

Principal Investigator:

Scott A Dye

Technology Maturity (TRL)

Start: 2
 Current: 4
 Estimated End: 4

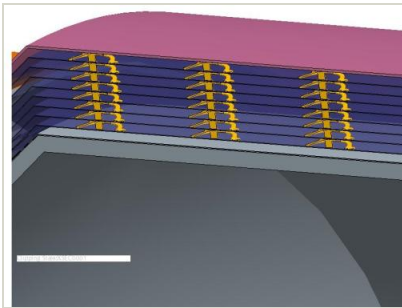


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Images



Briefing Chart Image

Multi-Environment MLI: Novel Multi-functional Insulation for Mars Missions, Phase I Briefing Chart Image
(<https://techport.nasa.gov/image/131588>)

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.1 In-space Propellant Storage & Utilization